

POLLINATION OF AUSTRALIAN ORCHIDS BY *TRIGONA* (*TETRAGONA*) JURINE BEES (HYMENOPTERA: APIDAE)

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Abstract

Trigona bees are confirmed pollinators of five Australian species of *Dendrobium* Sw., two species of *Cymbidium* Sw., and *Caladenia carnea* R.Br., and are probable pollinators of other dendrobiums, a further *Cymbidium* species, and *Sarcochilus* R.Br. species in north-eastern Queensland. *Trigona carbonaria* Smith has been reported for several of these orchids, but a number of other *Trigona* species, presently undescribed or unidentified, are important in pollination.

Introduction

The genus *Trigona* of the tribe Meliponini contains eusocial bees which live in cavities or hollows of trees. They are distributed throughout tropical and subtropical areas around the world including the northern half of Australia, New Guinea, New World tropics, Africa, Asia and New Guinea (Wilson 1971).

Trigona bees are stingless and, in Australia, place their brood cells in clusters (subgenus *Plebeia*) or in horizontal combs with cells opening upwards (subgenus *Tetragona*). Honey and pollen are stored in large wax pots quite different from brood cells. New nests are established gradually by workers transporting nesting materials. A young queen eventually moves to a new nest with a group of workers, and interchange between old and new nests may continue for some weeks (Wilson 1971).

Australian species of *Trigona* have been poorly studied taxonomically. Michener (1965) listed at least 22 trivial specific names for the Australian and New Guinea fauna. In recent years there has been an increase in the number of observations of *Trigona* spp. pollinating Australian orchids, especially in *Dendrobium*. This report documents both new observations as well as all known records of *Trigona* pollination of Australian orchids and classifies them according to criteria for pollinator status (Adams and Lawson 1988).

New *Trigona* pollination records (Table 1)

Caladenia carnea 29.vii.1990. Flowers of this terrestrial species were observed to be pollinated 2 km east of Herberton, northern Queensland (17°16'S 145°24'E).

Cymbidium canaliculatum R.Br. 26.xi.1990. Several *Trigona* specimens were recorded at flowers of this fragrant epiphytic species near Herberton, northern Queensland.

Cymbidium suave R.Br. 9.x.1990. Several fragrant flowers of a large colony of plants growing on a fallen tree in the upper Walsh River (17°18'S 145°22'E) area near Herberton, northern Queensland were pollinated.

Dendrobium adae (Bailey) 21.viii.1990 and 22.viii.1990. Two flowers of this fragrant species, epiphytic on *Allocasuarina* sp. and *Banksia* sp., in the area of Mt Baldy, near the Walsh River, north-eastern Queensland, were pollinated.

Methods

Reports of pollination events from the literature and from recent observation have been classified (Table 1) according to the following definitions:

Confirmed pollinator:

Minimum criteria include observation of uptake of pollinia from the anther, travel to a flower of the same species with deposition on the stigma, and accurate identifications of orchid and pollinator (Adams and Lawson 1988).

Probable pollinator:

One or more of the minimum criteria have not been met. In most of these reports pollinia are taken up and identifications are correct but further visiting of flowers is not reported, or visits occur without deposition of pollinia on a stigma.

Suggested pollinator:

Most of these reports describe visitation of flowers or presence of potential vectors on flowers, with or without pollinia from an unidentified source.

Results

Trigona is a confirmed pollinator of *Dendrobium adae*, *D. kingianum* Bidw., *D. speciosum* Sm. (two varieties), *D. monophyllum* F.Muell., *Cymbidium madidum* Lindl., *Cymbidium suave* and *Caladenia carnea* (Table 1). It is also a likely pollinator of *D. lichenastrum* (F.Muell.) Kraenzl., two other varieties of *D. speciosum*, *Cymbidium canaliculatum* and *Sarcochilus moorei* (H.G. Reichb.) Schltr. Descriptions of the insects and the wide geographic range of the observations (Newcastle to Cape York Peninsula) suggest that a number of different species of *Trigona* are involved.

Discussion

At present, less than ten per cent of the more than seven hundred species of Australian orchids have been subject to pollination studies (Adams 1990). Reports of pollination by bees have been infrequent and include the genera *Lasioglossum* Curtis, *Hylaeus* Fabricius, *Euryglossina* Cockerell, *Exoneura* Smith and *Trigona* (Jones 1983; Adams 1990). Recent reports, including new observations in this study, indicate that *Trigona* is a pollinator of *Dendrobium* and several other fragrant epiphytic genera. It has not been recorded as a pollinator of terrestrial orchid species, except for *Caladenia carnea*. *Trigona* has now been recorded as a confirmed or probable

Table 1. Australian orchids pollinated or likely to be pollinated by *Trigona* species.

Orchid Species	Area	Pollination Status	Reference
<i>Dendrobium</i>			
<i>D. adae</i>	NE Qld	Confirmed	This report
<i>D. kingianum</i>	Central coast, NSW	Confirmed	Adams and Lawson (1987)
<i>D. lichenastrum</i>	NE Qld	Probable	Jones and Gray (1976)
<i>D. lichenastrum</i>	Townsville, NE Qld	Suggested	Smythe (1970)
<i>D. speciosum</i>	NE NSW	Confirmed	Adams (1991)
var. <i>hillii</i>			
<i>D. speciosum</i> var. <i>hillii</i>	SE Qld	Probable	Slater and Calder (1988)
<i>D. speciosum</i> var. <i>capricornicum</i>	Rockhampton, Qld	Confirmed	Adams (1991)
<i>D. speciosum</i>	Townsville, Qld	Suggested	Smythe(1970)
<i>D. speciosum</i> var. <i>pedunculatum</i>	NE Qld	Probable	Adams (1991)
<i>D. speciosum</i> var. <i>grandiflorum</i>	SE Qld	Probable	Adams (1991)
<i>D. teretifolium</i>	NSW or Qld #	Suggested	Jones (1983)
<i>Cymbidium</i>			
<i>C. canaliculatum</i>	NE Qld	Probable	This report
<i>C. madidum</i>	Townsville, Qld	Suggested	Smythe (1970)
<i>C. madidum</i>	Proserpine, Qld	Confirmed	Macpherson and Rupp (1934)
<i>C. madidum</i>	NE Qld	Confirmed	This report
<i>C. suave</i>	NE Qld	Confirmed	This report
<i>Sarochilus</i>			
<i>S. moorei</i>	NE Qld	Probable	Jones (1981)
<i>Pomatocalpa</i>			
<i>P. macphersoni</i>	NE Qld	Suggested	Jones (1981)
<i>Caladenia</i> (terrestrial)			
<i>C. carnea</i>	Herberton, Qld	Confirmed	This report

not specified

pollinator of seven epiphytic species and is likely to allow natural hybrids to develop in the *Dendrobium* Section *Dendrocoryne* (Adams 1990).

Nectar is not produced by these orchids and the bees are apparently attracted to a colourful floral display and intense fragrance. Aromatic chemical components of several dendrobiums have been identified (Adams 1990) and successfully used to attract *Trigona* bees.

Little attention has been directed to the taxonomic study of *Trigona* in Australia since Rayment (1935) observed natural colonies and hives. He identified pollen of *Eucalyptus* L'Herit, *Angophora* Cav., *Xanthorrhoea* Sm., *Hardenbergia* Benth. and *Helianthus* L. isolated from pollen storage pots, and studied two apparently distinct species, *T. carbonaria* and *T. cassiae* Cockerell in the Brisbane area.

Some pollination reports identify *T. carbonaria* but descriptions are not offered, and identification should be regarded with caution. A taxonomic study of *Trigona* will require location of colonies to describe nest architecture and morphology of all castes. Studies with varieties of *D. speciosum* in New South Wales and south-eastern and north-eastern Queensland involved *Trigona* of different size and appearance, likely to represent at least five different species.

Trigona bees have exploited a niche in Australian orchid pollination that is paralleled by the activity of euglossine bees in pollinating South American orchids. However the euglossines exhibit a more specific relationship with particular orchid species, whereas *Trigona* appear to be generalist pollinators (Adams 1990). All epiphytic orchids species listed in Table 1 exhibit the common features of mass flowering, and spicy, aromatic fragrance emitted under warm conditions when bees are actively foraging. The observations of terrestrial orchids are presently insufficient to define a particular pollination syndrome.

We hope that this report will stimulate an interest in interactions between orchids and *Trigona* bees and would appreciate receiving information about both visitation and pollination of orchids by *Trigona*, with specimens if possible.

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